



Acoustics

Sheet (2)

- 1- A submarine (sub A) travels through water at a speed of 8.00 m/s emitting a sonar wave at a frequency of 1400 Hz . The speed of sound in water is 1533 m/s . A second submarine (sub B) is located such that both submarines are travelling directly toward one another. The second submarine is moving at 9.00 m/s .

- (a) What frequency is detected by an observer riding on (sub B) as the subs approach each other?
- (b) The subs barely miss each other and pass. What frequency is detected by an observer riding on (sub B) as the subs recede from each other?

What if? While the subs are approaching each other, some of the sound from sub A will reflect from sub B and return to sub A. If this sound wave to be detected by an observer on sub A, what is its frequency?

- 2- A train is moving parallel to a highway with a constant speed of 20.0 m/s . A car is travelling in the same direction as the train with a speed of 40.0 m/s . The car horn sounds at a frequency of 510 Hz , and the train whistle sounds at a frequency of 320 Hz .

- (a) When the car is behind the train, what frequency does an occupant of the car observe for the train whistle?
- (b) After the car passes and is in front of the train, what frequency does a train passenger observe for the car horn?

- 3- Standing at a crosswalk, you hear a frequency of 560 Hz from the siren of an approaching ambulance. After the ambulance passes, the observed frequency of the siren is 480 Hz . Determine the ambulance's speed from these observations.

- 4- At 10°C , how far away is a reflecting surface if you hear an echo in 0.274 s ?